

LA-UR-19-28639

Approved for public release; distribution is unlimited.

Title: NDA & NMAC at LANL Overview

Author(s): Karpus, Peter Joseph

Intended for: Visit by Egyptian Atomic Energy delegation

Issued: 2019-08-26

Disclaimer:

Los Alamos National Laboratory, an affirmative action/equal opportunity employer, is operated by Triad National Security, LLC for the National Nuclear Security Administration of U.S. Department of Energy under contract 89233218CNA000001. By approving this article, the publisher recognizes that the U.S. Government retains nonexclusive, royalty-free license to publish or reproduce the published form of this contribution, or to allow others to do so, for U.S. Government purposes. Los Alamos National Laboratory requests that the publisher identify this article as work performed under the auspices of the U.S. Department of Energy. Los Alamos National Laboratory strongly supports academic freedom and a researcher's right to publish; as an institution, however, the Laboratory does not endorse the viewpoint of a publication or guarantee its technical correctness.



NDA & NMAC at LANL Overview

August 2019

UNCLASSIFIED

Introduction

- LANL has a long history supporting non-destructive assay (NDA)
 - Hardware
 - Software
 - Techniques
- NDA plays a key role in Nuclear Security under as part of Nuclear Materials Accounting and Control (NMAC)

UNCLASSIFIED

Historical Figures

**Sigvard Eklund, DG
of IAEA**

**Bob
Keepin,
MC&A
Pioneer**



**Norris
Bradbury,
LASL
Director**

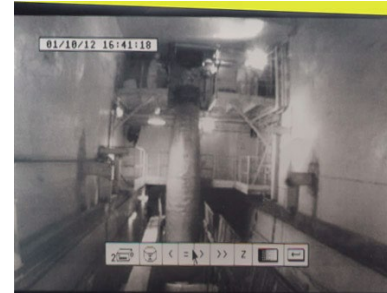
UNCLASSIFIED

Over 50 Years of LANL Support to the IAEA

- Technology development
- IAEA inspector training
- Staff for rotational assignments in Vienna



Training on active neutron coincidence counter



Transfer cask at Chernobyl



UNCLASSIFIED

Some NDA Tools Developed at LANL

High-Level Neutron Counter

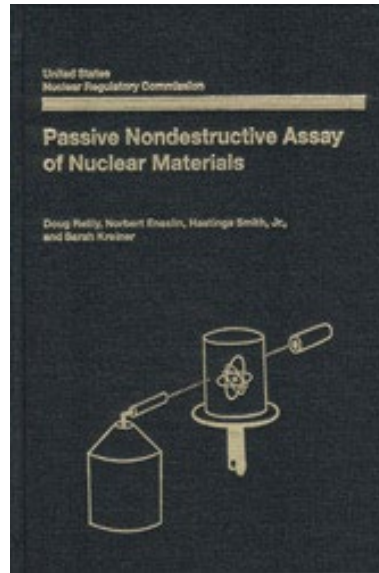


JSR-15



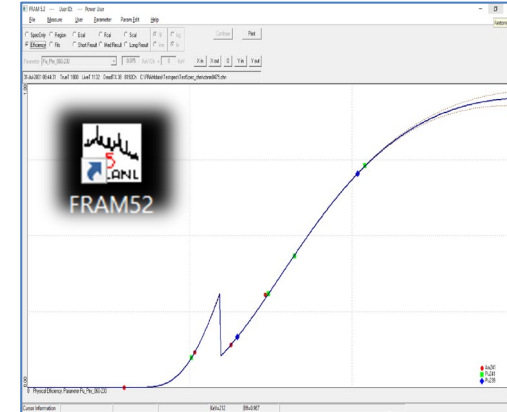
Figure 1 JSR-15/HHMR Prototype picture

The PANDA Manual



UNCLASSIFIED

FRAM: U/Pu Isotopic Analysis



Cerenkov-Viewing Device



LANL NDA Training Program

- Domestic training began in 1973
- IAEA inspectors participation began in 1974
- Dedicated IAEA NDA training began in 1980
 - Since 1980 inspectors from every IAEA training class have attended the course
- Courses utilize extensive inventory of nuclear material standards including pure and impure Pu standards, U standards, fresh fuel assemblies, MTR Fuel elements, and MOX standards.
- Since its inception in 1973, LANL has conducted >320 courses, >5600 students, >800 IAEA inspectors

UNCLASSIFIED

8/23/2019

IAEA Inspector Training

nature



SCHOOL OF NUKES

How do nuclear inspectors know when all is not as they are told?
Geoff Brumfiel joins some inspectors-in-training as they learn the ropes at the Los Alamos National Laboratory.

A half-past eight in the morning, the New Mexico sun already hot on our necks, we gather outside what could be the entrance of a high-security prison. Past the guard post and fence line is a windowless building that covers about a city block. G20-like vents along the building's side give it the look of a leviathan beached ungraciously in the high desert.

This is the Chemistry and Metallurgy Research building at Los Alamos National Laboratory, the United States' oldest nuclear-weapon laboratory. The 1,000-square-metre building is the weapons programme's main centre for the study of nuclear material.

Weapons. The inspectors are "the eyes and ears on the ground", says David Albrecht, head of the Institute for Science and International Security, a non-proliferation group based in Washington D.C. "And they're quite effective."

When I was younger, I entertained the thought that I, too, might want to be a nuclear inspector. I imagined travelling the world with a diplomatic passport, turning up unexpectedly at secretive facilities and mucking with local despots. So when the IAEA offered to let me tag along on the first few days of this jagged course I jumped at the chance.

My two days as a student there

be personable enough to win the trust of local plant managers. They must be jacks and jills of all trades.

To reach that goal, inspectors undergo a grueling three-month induction and take continuing education courses in subjects as diverse as international law, psychology and the imagery analysis and environmental sampling throughout their career. But at the heart of it all is the need to be able to verify whether the container in front of them contains the radioactive material that its custodian claims is inside. And that's why they train at Los Alamos. In the belly of the metal labyrinth beneath, they have an opportunity to get to grips with pure weapons-grade uranium and plutonium.

Standing in

If it weren't for the fact that we're shuffling about in front of one of the world's most fortified scientific laboratories, we'd be an examining group. We come from

11 countries, spanning the globe from Argentina to Indonesia. All

"The inspectors

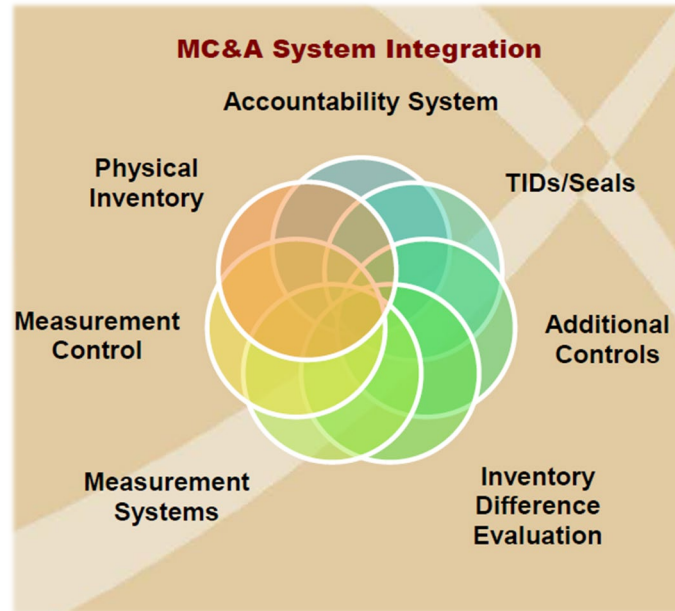
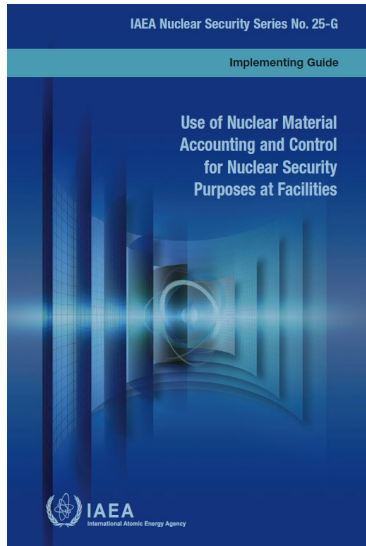
- Current inspector training course:
 - is a 9 days in length
 - provides fundamental understanding and proper application of gamma-ray and neutron NDA instrumentation used by the IAEA
 - Inventory verification exercise.
- The 48th Nondestructive Assay Inspector Training course was featured in Nature.

G. Brumfiel, **Nature** 449, 656 (2007)

UNCLASSIFIED

NMAC for Nuclear Security

“Both the State competent authority and the operator need to recognize the importance of using NMAC for nuclear security purposes. NMAC should be promoted within the nuclear security culture as an important contributor to nuclear security.” (from the IAEA Pub. G25)

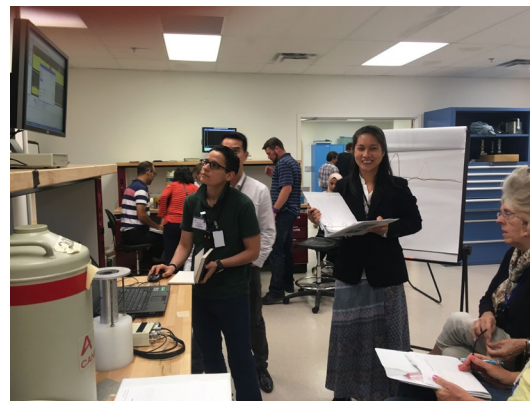
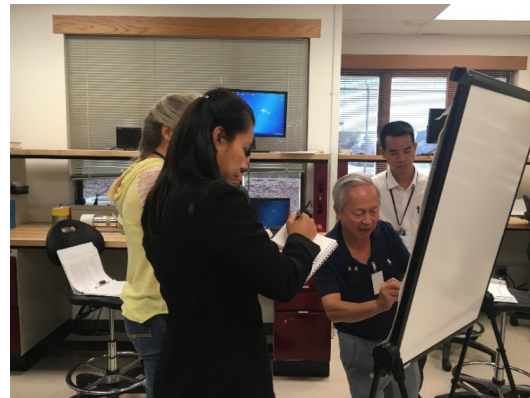


COURSE AGENDA
 International Atomic Energy Agency
INTERNATIONAL TRAINING COURSE
“NMAC for Practitioners”
20-30 August, 2018
Los Alamos National Laboratory
Los Alamos, New Mexico

UNCLASSIFIED

NMAC Training at LANL: Gamma

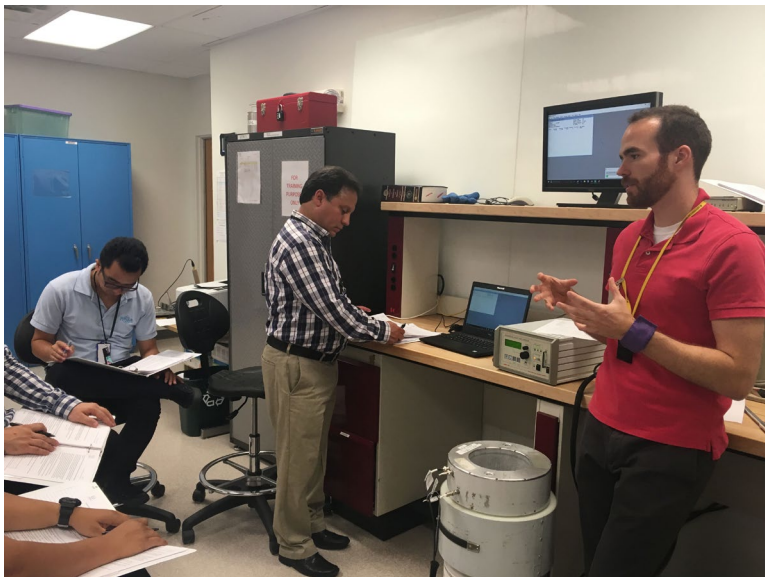
Participants learn to do gamma-ray measurements for nuclide identification, uranium enrichment, and plutonium isotopic-composition analysis.



UNCLASSIFIED

NMAC Training at LANL: Neutron

Participants learn to do neutron coincidence-counting measurements to determine mass of special fissionable material.



UNCLASSIFIED

Summary

- Los Alamos has a long history of development of tools and methods for non-destructive assay of nuclear materials.
- LANL also has many years of experience in teaching non-destructive assay.
- **NDA** is a key component of **NMAC**
- **NMAC** is a key component of **Nuclear Security**

UNCLASSIFIED